FORM PTO-1390 (REV 12-29-99) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 72.011

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/508356

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US98/05392	25 Aug 1998 (25.08.98)	10 Sept 1997 (10.09.97)

TITLE OF INVENTION: WORKING MACHINE WITH REDUCED UPPER MASS VIBRATIONS

APPLICANT(S) FOR DO/EO/US: Martin GREPPMAIR

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [XX] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [XX] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [XX] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [XX] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [XX] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [XX] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [XX] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [XX] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [XX] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [XX] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [XX] An Information Disclosure Statement under 37 CFR 1.97 and 1.98. and references
12. [XX] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [XX] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [ ] Other items or information:

U.S. APPLICATION NO (If known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/508356	PCT/US98/05392	72.011

17. ☒ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$970.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$840.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$690.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$670.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$96.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		X $18.00	$	
Independent claims	- 3 =		X $78.00	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $260.00	$	
TOTAL OF ABOVE CALCULATIONS =				$ 840.00	
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also by filed (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$ 840.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐20 ☐30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 840.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 880.00	
				Amount to be refunded:	$
				charged:	$

a. ☒ A check in the amount of $ 880.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1170. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO.

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SIGNATURE

Timothy E. Newholm
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REGISTRATION NUMBER

March 9, 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

National Phase of PCT/EP98/05392

International Filing Date: August 25, 1998

Inventor: Martin Greppmair

Title: *Working Machine with Reduced Upper Mass Vibrations*

Priority: German Application No. 197 39 743.3; Filed September 10, 1997

PRELIMINARY AMENDMENT

DO/EO/US
Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Sir:

This Preliminary Amendment is directed to a new U.S. application as identified above. Please enter this Preliminary Amendment prior to calculating the fees.

Please amend the application as follows:

IN THE SPECIFICATION:

Page 1, after the title, insert the heading --BACKGROUND OF THE INVENTION--; and subheading --1. Field of the Invention--.

Page 1, between lines 5 and 6, insert the subheading --2. Description of the Related Art--.

Page 3, before line 1, insert the heading --OBJECTS AND SUMMARY OF THE INVENTION--.

Page 3, between lines 37 and 38, insert the heading --BRIEF DESCRIPTION OF THE DRAWINGS--.

Page 4 between lines 5 and 6, insert the heading --DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

IN THE CLAIMS:

Claim 1, line 3, delete "(3, 4, 5, 6, 7, 16)" and insert --(3, 4, 5, 7, 16)--;

line 5, delete "(5, 6, 7, 16)" and insert --(5, 7, 16)--;

line 8, delete "piston"; and

line 9, delete "pin(6)".

Claim 3, line 1, delete "claim 1 or 2" and insert --claim 1--.

ABSTRACT OF THE DISCLOSURE:

Please add Page 7 as the Abstract of the Disclosure.

REMARKS

This application has been amended to insert headings in the specification, to eliminate the multiple dependencies in the claims, and to add an Abstract of the Disclosure. Claim 1 has additionally been amended at lines 3, 5, 8, and 9 to enter amendments made to the PCT application under Article 34. Entry of the amendments and early consideration and allowance are respectfully requested.

Respectfully submitted,

Timothy E. Newholm
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Dated: March 9, 2000
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09/508356
430 Rec'd PCT/PTO 09 MAR 2000

Working machine with reduced upper mass vibrations

The invention relates to a working machine according to the preamble of patent claim 1. The invention relates, in particular, to a tamping machine for soil compaction or to a hammer.

Known tamping machines of this type are designed in such a way that an upper mass receiving a motor and a crank mechanism is connected via a spring assembly to a working mass which forms essentially a working or compacting plate. The rotational movement generated by the motor is converted by the crank mechanism into an oscillating axial movement which is transmitted via the spring assembly to the working plate for soil compaction. The upper mass comprises about two thirds and the percussive working mass one third of the entire tamper mass, whilst the distances covered in each case by the upper mass and the working mass are in inverse proportion to one another. The order of magnitude in which the upper mass moves in this case is 25 to 30 mm.

The vibrations of the upper mass are transmitted via a guide handle to the person guiding the working machine, and is very unpleasant, particularly when the work lasts a relatively long time. In this context, vibrations in the horizontal or lateral direction are particularly troublesome for the operator. By contrast, vibrations in the vertical direction are necessary for the tamper to work efficiently.

Figure 2 shows a known tamper of this type.

According to Figure 2, a drive shaft 1 of the tamper is driven by a motor, not illustrated, the drive shaft driving, via a pinion 2, a crank disk 3 mounted in the tamper housing and provided with external toothing. Attached to the crank disk 3 is a crank pin 4, onto which a connecting rod 5 is placed in a rotationally movable manner. The connecting rod 5 is connected at its other end to a guide piston 7 in a rotationally movable manner by means of a piston pin 6. The guide piston 7 carries a piston guide 9 formed by a steel disk and fastened by means of a nut 8. The guide piston 7 is movable axially back and forth, by means of the piston guide 9 within a guide tube 10 belonging to the lower mass. This axial direction corresponds to a vertical or working direction of the machine when it is being used.

A spring assembly 11 consisting of a plurality of springs is arranged on both sides of the piston guide 9, the springs in each case being supported, on their side facing away from the piston guide 9, against spring plates 12 fastened to the guide tube 10. In order to avoid the spring assemblies 11 being blocked together, a damping bush 13 made from an elastic plastic is placed onto the guide piston 7 above the piston guide 9, whilst a damping plug 14, likewise consisting of elastic plastic, is attached below the nut 8. When the spring assemblies 11 are highly

compressed, the damping bush 13 and the damping plug 14 can in each case butt onto the associated spring plate 12 with their side facing away from the piston guide 9. They then damp the further compressive movement in such a way that the situation can be avoided where the spring assemblies 11 are blocked together and an excessive impact action is consequently exerted on the working machine.

The guide tube 10, together with the spring plates 12, belongs to the working or lower mass of the tamper. A tamping foot, not shown in Figure 1, which serves for soil compaction may be attached to the lower mass. In order to avoid the penetration of moisture and dirt, the upper mass and the lower mass are connected by means of an elastic concertina 15.

As is apparent from Figure 2, the rotational movement of the motor is converted into an oscillating axial movement of the guide piston 7 by the crank mechanism by means of the crank disk 3, the crank pin 4 and the connecting rod 5. This axial movement is transmitted via the spring assemblies 11 to the guide tube 10 and consequently to the lower mass and can be utilized for soil compaction.

In order to damp the vibrations acting on the operator, it has been known hitherto to uncouple the guide handle from the upper mass mechanically by means of rubber elements. In this case, however, the mounted drive motor still remains exposed to high vibrational loads. An improvement in vibration damping can be achieved here only at a high outlay in terms of construction.

It is therefore desirable, from the outset, to avoid vibrations of the upper mass occurring.

DE-A 19 25 870 discloses a tamper for soil compaction, with a working mass which is driven linearly back and forth, via a double crank mechanism, by a motor belonging to an upper mass. In order to reduce the vibrations on the upper mass, two weights moveable in opposition are provided, which superpose an oppositely directed vibration on the vibration generated by the crank mechanism. The tamper has a double-leg design, each tamper leg being driven via its own crank mechanism. The tamper correspondingly has a very large build and can be guided on the ground only with great effort.

DE-Patent 753 502 discloses a drive device for exciting vibratory systems. For this purpose, arms and levers coupled to one another via rubber springs are provided in a crank mechanism. In order to avoid harmful dynamic mass action in the form of forces reacting on the motor and the bearings, the mass of the arms and levers is kept as low as possible, using materials of low specific gravity.

The object on which the invention is based, therefore, is to specify a working machine in which vibrations of the upper mass can be avoided as soon as they occur.

The object is achieved, according to the invention, by means of a working machine having the features of patent claim 1.

It was shown, surprisingly, that the vibrations of the upper mass can be reduced considerably if materials which are lighter than steel, that is to say have a lower density than steel, are used for producing the structural elements of the crank mechanism which are moveable linearly back and forth, that is to say, in particular, the connecting rod, piston pin, guide piston and piston guide. This is attributable to the fact that the mass of the upper mass is reduced due to the lower weight of the moveable components, with the result that lower forces act on the upper mass.

It is particularly advantageous if the material is an aluminum alloy or a plastic, because a particularly large reduction in mass is possible thereby.

In the working machines known hitherto, in particular in tampers, attempts have usually been made to damp the vibrations acting on the operator by vibrationally insulating the guide handle of the machine from the machine itself, for example by means of rubber elements. It was also known to reduce the upper-mass vibration by superposing an additional vibration generated separately. However, it is not yet known to reduce the vibrations as soon as they occur by the use of lightweight components.

In addition to reducing the movement of the upper mass, the reduction in mass of the moved components also has the advantage of saving energy, since lower masses have to be accelerated and decelerated during each crank revolution. The overall weight of the machine can likewise be reduced. On account of the lower accelerative load on the drive motor, longer service lives can be achieved. On the other hand, assuming the same power output of the motor, it is possible to use somewhat wider or heavier tamping plates, whilst at the same time ensuring the same upper-mass movement or acceleration. Furthermore, the running noise can be reduced. Moreover, considerable cost reductions may be expected in a corresponding production method. The essential advantage, however, is the reduction in the hand-arm vibrations acting on the operator, thereby making it possible to work in greater comfort.

In a particularly advantageous embodiment, the piston guide can be produced from plastic in one piece together with a damping bush, preferably with two damping bushes. In addition to the mass reduction mentioned, this leads to a simplification of the production method and therefore likewise to a cost reduction.

This and other features of the invention are explained in more detail below with the aid of the figures, of which:

Figure 1 shows a sectional illustration of part of a tamping machine according to the invention;

Figure 2 shows a part section through a known tamping machine.

Since essential structural elements of the tamping machine according to the invention as shown in Figure 1 correspond to the known elements already described in connection with Figure 2, there is no need for a renewed description. For the sake of simplification, the same reference symbols are also used for identical components in the figures.

In contrast to the known tamper shown in Figure 2, in the tamper according to the invention shown in Figure 1, some of the structural elements of the crank mechanism which are movable linearly back and forth are produced from materials which have a lower density than steel and are therefore lighter than steel. Depending on the overall size and performance of the tamper, a decision must be made, in each individual case, as to which structural elements must be produced from lighter materials. In principle, however, in order to avoid upper mass vibrations, the aim is for as many structural elements as possible to have a lightweight design.

The relevant structural elements are the connecting rod 5, the piston pin 6, the guide piston 7 and a piston guide 16 designed according to the invention. The crank mechanism itself consists of the crank disk 3, the crank pin 4, the connecting rod 5, the piston pin 6, the guide piston 7 and the piston guide 16.

The connecting rod 5 may be produced preferably from plastic, for example from carbon fiber- or glass fiber-reinforced polyamide. Wrought aluminum alloys or, likewise, glass fiber-reinforced polyamide are suitable for the guide piston 7.

The connecting rod 5 consisting of plastic has some elasticity and therefore spring properties. This elasticity is assisted by an o-leg shape, that is to say by an arcuate run of the connecting rod 5 between the crank pin 4 located on the crank disk 3 and the piston pin 6 arranged on the guide piston 7. The connecting rod 5 therefore forms an oval "O", through the center of which the drive shaft 1 extends. The lateral legs of the "O" improve the springing or damping capacity of the connecting rod 5, with the result that the bearings and toothings and also other components connected to the connecting rod 5 are protected.

The piston guide 16 integrates in one component the steel piston guide known from the prior art, the expansion bush consisting of an elastic plastic and the expansion plug. The piston guide 16 has, approximately in the middle, a wider edge 17, against the two sides of which the spring assemblies 11 come to bear. A

sleeve extends from the edge 17 in each of the two directions, an upper expansion sleeve 18 being slipped over the guide piston 7 and a lower expansion sleeve 19 likewise extending in sleeve form in the direction of the lower mass. In order to avoid the spring assemblies 11 being blocked together, if strong vibration occurs the ends of the expansion sleeves 18, 19 can butt onto the respective spring plates 12 before the spring turns touch one another. An excessive impact load on the machine is thereby avoided. In order to ensure a corresponding damping capacity of the piston guide 16, the latter is produced in one piece from polyurethane. In order to reinforce the edge 17, in particular to avoid the piston guide 16 being damaged by the spring assemblies 11 resting on it, it is possible to insert thin steel disks between the edge 17 and the associated springs 11.

The piston guide 16 is screwed on the guide piston 7 via a trapezoidal thread 20. The trapezoidal thread 20 ensures contact over a large area between the piston guide 16 and the guide piston 7, so that the local surface pressure can be kept low.

For the prevention of rotation, there is formed inside the lower expansion sleeve 19 an inner hexagon 21, into which a steel piece 22 having an outer hexagon can be pushed and can be fixed to the guide piston 7 by means of a screw 23. This arrangement ensures that, when the machine is in operation, the piston guide 16 cannot independently unscrew itself down from the guide piston 7.

The invention was explained above in terms of a tamping machine according to the invention for soil compaction. Furthermore, the invention may likewise be used highly advantageously in a hammer, for example a compression hammer, since percussion generation in the hammer is based on the same principle as in the tamping machine. The fact that, in the hammer, a pneumatic spring percussion unit is normally used instead of the steel springs forming the spring assemblies 11 has no influence on the positive effects of the embodiment according to the invention.

A weight saving of several kilograms can be achieved by using plastics. However, this saved weight may also be added to the upper mass, so that the latter increases in mass, as compared with devices known from the prior art. The upper mass consequently becomes quieter during operation, with the result that fewer hand-arm vibrations are transmitted to the operator. The overall mass of the tamper remains constant, as compared with when the relevant components are produced from steel.

Abstract of the Disclosure

According to the invention, a hammer or a ramming machine for compacting soil has a crank mechanism for producing a directed vibration. The crank mechanism is coupled to a spring assembly. The parts of the crank mechanism which move back and forth linearly are made from a material with a density less than that of steel. This construction prevents vibrations which are unpleasant for the person operating the working machine from occurring.

New patent claims

1. A tamping machine for soil compaction, with a working mass which is driven in a tamping manner and which can be driven linearly back and forth, via a crank mechanism (3, 4, 5, 7, 16) and a spring assembly (11), by a motor belonging to an upper mass, wherein the crank mechanism has at least one structural element (5, 7, 16) which is moveable linearly back and forth and which can be produced from a material, the density of which is lower than that of steel, and wherein the structural element which is moveable linearly back and forth is a structural element from the group comprising a connecting rod (5), guide piston (7), piston guide (16).

2. The tamping machine as claimed in claim 1, wherein the material is an aluminum alloy.

3. The tamping machine as claimed in claim 1 or 2, wherein the material is a plastic.

4. The tamping machine as claimed in claim 1, wherein the piston guide (16) can be produced from plastic in one piece together with at least one damping bush (18, 19).

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **WORKING MACHINE WITH REDUCED UPPER MASS VIBRATIONS**, which is described and claimed in

- ☑ the attached specification.
- ☐ the specification in application _____, filed on _____ and amended on _____ (if applicable).
- ☐ international (PCT) application No. _____, filed on _____ and as amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Claimed
197 39 743.3 (Number)	Germany (Country)	10 September 1997 (Day/Month/Year Filed)	☑ Yes ☐ No
PCT/EP98/055392 (Number)	PCT (Country)	25 August 1998 (Day/Month/Year Filed)	☑ Yes ☐ No
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐ Yes ☐ No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is known to be material to the patentability of this application as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Number)	(Filing Date)	(Status - Patented, Pending, Abandoned)
(Application Number)	(Filing Date)	(Status - Patented, Pending, Abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: James F. Boyle, Reg. No. 33,653; Timothy E. Newholm, Reg. No. 34,400; Timothy J. Newholm, Reg. No. 38,368; David D. Stein, Reg No. 40,828; Michael J. Gratz, Reg. No. 39,693.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor (given name, family name): Martin GREPPMAIR

Inventor's signature: Martin Greppmair Date: 06 März 2000

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Application deficiencies found during scanning:

☑ Page(s) 6 of Specification (Document title) were not present for scanning.

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